

EFFECT OF SPIRULINA (*Arthrospira platensis*) ADDITION ON LEVEL OF PREFERENCE IN CEREAL BAR

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ABSTRACT

This study aims to determine the best level of addition of spirulina flour to the most favorable cereal bars based on organoleptic characteristics. The research method was carried out experimentally, consist of 4 treatments with 0%, 9%, 12%, and 15% addition of spirulina flour with 20 semi-trained panelists as repetitions. Parameters observed were organoleptic characteristics which included appearance, aroma, taste and texture and proximate analysis. The analysis of favorability uses Friedman test while the determination of the most important characteristic using Bayesian method. Hedonic test and proximate test were analyzed descriptively. Based on the results of the study, the most favorable product by the panelists was spirulina cereal bars with the addition of 12% spirulina flour which had a good appearance, had a distinctive but not too strong aroma, a sweet and savory taste, and a dense and chewy texture, with a median value of appearance, aroma, taste, texture of 7 each. The results of the proximate test showed that the most preferred cereal bar with the addition of 12% spirulina had a water content of 12.68%, 2.14% of ash, 66.07% of carbohydrates content, 13.09% of protein content and 6.02% of fat content.

Keywords: - Spirulina flour; cereal bar; preference level; proximate analysis.

1. INTRODUCTION

Spirulina sp. is one type of microalgae that has the potential as a food source because spirulina sp. is rich in nutrients including proteins, vitamins, amino acids, -linolenic acid (GLA), phycocyanins, tocopherols, chlorophyll, and -carotene (Belay et al. 1996). The use of spirulina flour has been widely developed in Indonesia, such as for cosmetics, health products, food additives, animal feed additives, and fish feed additives. This is because spirulina flour mostly contains 55-70% protein, 4-6% fat, 17-25% carbohydrates, polyunsaturated fatty acids such as linoleic and linolenic acids, several vitamins such as nicotinic acid, riboflavin (vitamin B2), thiamin (vitamin B1), cyanocobalamin (vitamin B12), minerals, amino acids, and other active ingredients such as carotenoids, chlorophyll pigments, and phycocyanins. [1]

Cereal bars are one of the most popular and favorite types of snacks for Indonesian people, that can be consumed by children, teenagers to adults and also from various economic groups. One of the food product developments is spirulina cereal bar, where the addition of spirulina flour is expected to improve the nutritional quality of cereal bar. The addition of spirulina to food products will scientifically increase the protein content, but will have implications for the appearance and taste and aroma. Therefore, this article aims to determine the scale of acceptance of these spirulina cereal bar.

2. METHOD

The method used in this study is an experimental method, with organoleptic testing (hedonic test) to determine the effect of adding spirulina flour to the characteristics and level of preference for cereal bar. The research design used for the parameters of appearance, aroma, taste and texture using four treatments and 20 semi-trained panelists as repetitions and then analyzed with non-parametric statistics Friedman test. The 4 treatments are as follows:

1. Treatment A: Addition of 0% spirulina flour (control)
2. Treatment B: Addition of 9% spirulina flour
3. Treatment C: Addition of 12% spirulina flour
4. Treatment D: Addition of 15% spirulina flour

2.1 Research Procedure

The procedure for making cereal bars based on a preliminary test with the addition of spirulina flour is carried out in several stages as follows:

1. Spirulina flour, oatmeal, whole wheat cereal, peanuts and salt are roughly mixed by shaking in a container then slowly add corn syrup and vanilla extract and stir using a spoon until well mixed.
2. The mixed ingredients are placed inside a baking tray layered with parchment paper and then pressed with a spoon until firm.
3. The ingredients then baked in the oven at 170°C for 7 minutes.
4. The cereal bar then cut into squares and served to a serving container or plate to be assessed by a panelist of 20 people.

Based on the results of the preliminary test of the cereal bar formulation, it can be seen in **Table 1**, which is as follows:

Table -1. Cereal Bar Formulation

| Ingredients | Content |
|--------------------|---------|
| Oatmeal | 200 g |
| Whole-Wheat Cereal | 60 g |
| Peanuts | 10 g |
| Salt | 0.3 g |
| Corn Syrup | 30 ml |
| Vanilla Extract | 2.5 ml |

2.2 Organoleptic Test

Organoleptic test is an assessment method using the human senses (eyes, nose, hands, tongue) with sensory abilities. One of the organoleptic tests is the hedonic test (level of preference). Hedonic test is used to assess the final product [2]. Hedonic testing includes the characteristics of appearance, aroma, taste and texture so that it can determine the level of panelists' preference for spirulina cereal bars. This test was conducted by 20 semi-trained panelists. The preference test procedure includes:

1. Prepared tools and materials such as: plates for spirulina cereal bar samples, plain water to neutralize the taste, organoleptic test forms, and cereal bar tests.
2. An explanation was given to the panelists regarding the test parameters which include appearance, aroma, taste and texture with a value scale of 1 to 9.
3. Each panelist was asked to give an assessment of the spirulina cereal bar in each treatment on the score sheet.

The results of the organoleptic test assessment will usually produce the same number of numbers so that an analysis is needed that can provide differences in each treatment. The analysis in question is the Bayes test, a test that aims to determine the comparison of determining criteria in a product. The processes produced by the Bayes test are a basis used in determining the most preferred product. The results of the Bayes test calculation will show that the element that has the highest priority value is the most preferred by the panelists [3].

2.3 Data Analysis

Organoleptic test results were analyzed by non-parametric statistic Friedman method. The test method used to determine the priority value of the selected product is the Bayes method. Selection of the best sample using the Bayes method is based on the highest total value of each treatment. The weighted parameters include organoleptic characteristics (appearance, aroma, taste and texture).

3. RESULTS AND DISCUSSION

3.1 Hedonic Test

The hedonic test was carried out to determine the quality based on the panelists' responses to the level of preference for the spirulina cereal bar product. Hedonic test is used to assess the level of final preference of the product. Hedonic testing was carried out by 20 semi-trained panelists. Parameters tested include the characteristics of appearance, aroma, taste, and texture of cereal bars from various treatments with the addition of spirulina flour.

3.2 Appearance

Appearance is the first parameter that consumers see visually before finally going to other factors. Appearance is one of the parameters that determine the level of acceptance of panelists assessed by sight including shape, size, color and surface properties (Rough yet firm, gloomy, glossy, and homogenous) [4]. The value of the liking level of the appearance of cereal bar spirulina is presented in **Table 2**.

Table -2. Level of Liking for the Appearance of Cereal Bar Spirulina

| Treatment | Median | Average |
|-------------------------------------|--------|---------|
| A (Control) | 7 | 6.20a |
| B (Additon of 9% Spirulina Flour) | 5 | 5.40a |
| C (Additon of 12% Spirulina Flour) | 7 | 6.30ab |
| D (Addition of 15% Spirulina Flour) | 5 | 4.50a |

Based on the results of research on appearances conducted by panelists, it can be seen that the average value ranges from 4.50 to 6.30 and has a median value of 5 to 7 on a scale of 1 to 9 which is included in the neutral category and favored by panelists. Friedman's statistical test results show that there are noticeable differences so that it can be concluded that the addition of spirulina flour can affect the acceptance rate and have a significant influence on the appearance of cereal bar spirulina. Based on the results of research on the appearance of cereal bar spirulina, results were obtained on **Figure 1**. as follows.



(A)



(B)



(C)



(D)

Fig -1. Cereal Bars Appearance with The Addition of Spirulina Flour Concentration of 0% (A), 9% (B), 12% (C), and 15% (D)

The test results showed that the C treatment, namely the treatment with the addition of 12% spirulina flour, had the highest average value with a value of 6.30 with a perfectly square shape, solid surface and bright green color. While the D treatment with the addition of spirulina flour as much as 15% has the lowest average value of 4.50 with a slightly rough surface and a slightly darker green color. Color is the dominant factor in appearance parameters that affect the scale of cereal bar acceptance because color can provide a sign of chemical changes in a food product and visually the color factor will appear first compared to shape and size [5].

3.3 Aroma

One of the important factors that determine the degree of liking of a product by panelists is aroma. If a product has a bad aroma, it will result in the product being less liked by the panelists. The fragrance is more influenced by the five senses of smell. In general, the aroma that can be accepted by the nose and brain is a mixture of four kinds of aromas, namely fragrant, sour, rancid, and charred [6]. The resulting value of the degree of liking for the aroma of cereal bar spirulina is presented in **Table 3**.

Table -3. Level of Liking for The Aroma of Cereal Bar Spirulina

| Treatment | Median | Average |
|-------------------------------------|--------|---------|
| A (Control) | 7 | 7.10ab |
| B (Addition of 9% Spirulina Flour) | 7 | 6.20a |
| C (Addition of 12% Spirulina Flour) | 7 | 6.80a |
| D (Addition of 15% Spirulina Flour) | 5 | 4.70a |

Based on the assessment of the aroma in the cereal bar spirulina product, the result was obtained that the addition of spirulina flour to the cereal bar resulted in an assessment of a significantly different aroma. Based on the results of the tests conducted, it was found that cereal bars with the addition of spirulina flour of 0% (A) were the most preferred treatment by the panelists with an average value of 7.10. Meanwhile, the treatment with the addition of spirulina flour of 15% (D) was the treatment that had the lowest level of favorability by the panelists with an average value of 4.70. The low acceptance scale for aroma parameters in test cereal bars with a spirulina composition of 15% is due to the strong enough spirulina aroma compared to other cereal bar that have a lower spirulina composition. The concentration of spirulina flour addition greatly affects the aroma in the cereal bar, the higher the concentration added to the cereal bar formulation, the aroma of the cereal bar is increasingly disliked by the panelists. The smell of spirulina is known is like the characteristic aroma of algae where this aroma is less liked by the panelists.

3.4 Taste

Taste is a very decisive factor in consumers' decisions on the acceptance of a food product. Although other parameters are good such as appearance, aroma, and texture, but if the taste of a product is not good then consumers will not like the product. The value of the result of the degree of liking for the taste of cereal bar spirulina is presented in **Table 4**.

Table -4. Level of Liking for The Taste of Cereal Bar Spirulina

| Treatment | Median | Average |
|-------------------------------------|--------|---------|
| A (Control) | 7 | 6.20a |
| B (Addition of 9% Spirulina Flour) | 7 | 6.00a |
| C (Addition of 12% Spirulina Flour) | 7 | 6.60ab |
| D (Addition of 15% Spirulina Flour) | 5 | 5.10a |

Friedman's statistical test results show that there are noticeable differences in taste parameters. The results of the analysis explained that the treatment of adding 12% of spirulina flour was the best treatment with a value of 6.60, while the treatment of adding spirulina flour as much as 15% was the treatment that was at least preferred with a value of 5.10. This is because the addition of a certain amount of spirulina greatly affects the taste of cereal bar products.

3.5 Texture

Texture is a very important factor for the acceptance of a food product [7]. Texture is important in soft foods and crispy foods. Texture test is sensing associated with the sense of groceries or touch. The most important features

are the hardness, cohesiveness and water content of such food [8]. The value of the result of the degree of liking for the texture of cereal bar spirulina is presented in **Table 5**.

Table -5. Level of Preference for The Texture Of Cereal Bar Spirulina

| Treatment | Median | Average |
|-------------------------------------|--------|---------|
| A (Control) | 5 | 5.60a |
| B (Addition of 9% Spirulina Flour) | 7 | 6.20a |
| C (Addition of 12% Spirulina Flour) | 7 | 7.20ab |
| D (Addition of 15% Spirulina Flour) | 7 | 5.60a |

Friedman's statistical test results show that there is a noticeable difference, meaning that different treatments can have different influences on the texture of cereal bar spirulina. The results of the analysis carried out found that cereal bars with the addition of spirulina flour of 12% (C) were the most preferred treatment by panelists with an average value of 7.20. Meanwhile, the treatment with the addition of spirulina flour of 0% (A) and 15% (D) was the treatment that had the lowest level of favorability by the panelists with an equivalent average value of 5.60.

Cereal bars with a spirulina content of 12% have a dense texture and have the right spirulina content so that corn syrup can be more easily attached to cereal bar ingredients and not scatter when served so it was relatively much liked by panelists. While cereal bars with a spirulina content of 0% and 15% have a bad texture and density and the ingredients tend not to stick where when baked cereal bars become scattered so that the level of crispiness is low and less in demand Panelists.

The texture of cereal bars is generally influenced by the adhesive material and the roasting process. The texture of the cereal bar is thought to be influenced by the type of sugar used. The use of sugar in cereal bars can affect the density of the product which ultimately affects the texture of the cereal bar, this is in accordance with [9]. that the addition of sugar as an adhesive in the manufacture of cereal bars will cause binding during the roasting process that causes the cereal bar to have a dense and chewy texture.

3.6 Decision Making with the Bayesian Method

The Bayesian method aims to determine the best treatment based on the characteristics of appearance, aroma, taste and texture. This method is one of the techniques that can be used to perform analysis in the best decision making of a number of alternatives taking into account various criteria [3]. The results of the calculation against the value of the criteria and in determining the best treatment taking into account the appearance, aroma, taste and, texture of the cereal bar from the 20 panelists were presented in **Table 6**.

Table -6. Cereal Bar Hierarchy Value Criteria

| Criterion | Criteria Value |
|------------|----------------|
| Appearance | 0.08 |
| Aroma | 0.14 |
| Taste | 0.60 |
| Texture | 0.18 |

Based on the calculation of the weight of the criteria for the appearance, aroma, taste and texture of the doughnut, the results were obtained that the taste criteria had the highest value with a criterion weight value of 0.57. Next is followed by the aroma parameter, which is with a criterion weight value of 0.20. and the weight values of the appearance and texture criteria of 0.13 and 0.11.

Decision-making on alternative weight values from the criteria of appearance, aroma, taste and texture was carried out by multiple comparison tests (*Multiple Comparison*). The completion of the results of such pairwise comparisons is carried out by matrix manipulation to determine the weight of the criteria. The results of the calculation of the weight of the criteria for the appearance, aroma, taste and texture of cereal bar are presented in **Table 7**.

Table -7. Spirulina Cereal Bar Assessment Decision Matrix

| Treatment | Criterion | | | | Alternative Value | Priority Value |
|-----------|------------|-------|-------|---------|-------------------|----------------|
| | Appearance | Aroma | Taste | Texture | | |
| A | 7 | 7 | 7 | 5 | 6.64 | 0.261 |
| B | 5 | 7 | 7 | 7 | 6.84 | 0.268 |
| C | 7 | 7 | 7 | 7 | 7.00 | 0.275 |

| | | | | | | |
|--------|------|------|------|------|-------|-------|
| D | 5 | 5 | 5 | 5 | 5.00 | 0.196 |
| Weight | 0.08 | 0.14 | 0.60 | 0.18 | 25.47 | 1.00 |

Based on calculations using the *Bayes* method, it was found that the addition of spirulina flour 12% obtained the highest alternative value of 7.00, followed by the addition of 9% spirulina flour by 6.84, followed by the addition of 0% spirulina flour by 6.64, then the last by the addition of 1 5% spirulina flour by 5.00. Cereal bars with the addition of 1 2% spirulina flour were the most preferred treatment by the panelists.

4. CONCLUSION

Based on the results of research that has been carried out, it can be concluded that the rate of addition of spirulina flour by 12 % in cereal bars produces the most preferred product with good appearance characteristics, has a distinctive but not too pungent aroma, sweet and savory taste, and a dense and crisp texture, with a median value of appearance, aroma, taste, texture of 7 each (preferred).

5. REFERENCES

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